

BACON, GILBERT AND HARVEY

BEING

THE HARVEIAN ORATION

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS
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The Harveian Oration

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My first duty, Mr. President, is to thank you for having appointed me to the honourable office of Harveian Orator. This I do most warmly.

There are two reasons why Harvey should be placed in the select class of really great men. One is because he discovered that the blood circulates, being compelled to do so by the contraction of the heart ; the other, even more powerful, is because he was among the earlier scientists to show the value of properly conducted experiment. You, sir, so admirably emphasized this in the Harveian Oration of last year, and the late Professor Starling has, in his recent oration also laid such stress

on it, that there is no need for me to urge the point further.

Every man's mind is compounded of what is born within him, modified by impressions received from without. Therefore it is of interest to see who were the men around Harvey who might have influenced him. At Padua there were his teachers ; many Harveian Orators have dealt with this part of his life, but I propose to see if any of his own countrymen, perhaps without his knowledge, can have helped to mould such of his thoughts as led to his great discovery. I shall make many quotations which might be easily multiplied, but this, I trust, you will pardon, firstly, because in any argument it is necessary that the premisses should be precise ; secondly, because the language of Bacon is like music to the ear.

Inasmuch as Harvey and Francis Bacon, commonly called Lord Bacon—which is altogether wrong, his titles were Baron Verulam of Verulam and Viscount St. Alban—were contemporaries, we must consider whether it is likely that he swayed Harvey. The life of Bacon is a fascinating story, but lack of time

forbids me from saying anything about it which is not germane to my purpose, but it is pleasant to know that his traducers are in a minority, and that Spedding, who has studied Bacon more carefully than anyone, does not consider that they have made out their case.

ADVANCEMENT OF LEARNING.

Harvey published his discovery in 1628, and tells us that he had, for nine years and more, in his lectures, confirmed "these views by multiplied demonstrations in your presence, illustrated them by arguments and freed them from the objections of the most learned and skilful anatomists." His first mention of it is in his notebook dated 1616. "The Two Bookes of Francis Bacon of the Proficience and Advancement of Learning, Divine and Humane," were first published in 1605, when Harvey, who had been back from Padua for three years, was aged 27 years; twenty-three years before the publication of his discovery and several years before he made it. The "Advancement of Learning," "the first great book in English prose of secular interest"

(Church) had many readers, for three editions quickly appeared. When his "Instauratio" was issued, Bacon sent the King a copy, with a letter saying he thinks it will find many readers, "because I hear my former book of the 'Advancement of Learning' is well tasted in the Universities here, and the English colleges abroad; and this is the same argument sunk deeper" [1]. The "Advancement," which we thus see was widely read in the years immediately following its publication, implores those who wish to delve into the secrets of Nature to discountenance mere authority and not blindly to believe what they are told, but to seek knowledge for themselves by observation and experiment; it teaches how properly to use induction, it points out the hopelessness of the false methods of reasoning commonly used, it has much in it about medicine. It is a noble work, devoted to the lofty purpose of increasing knowledge; its language is so beautiful and dignified that it may be placed second to that of Shakespeare.

The first book contains an oblation to James I, because Bacon longed to persuade

the King to be interested in learning. In this he failed, as he had with Elizabeth.

Passing to the second book, which is the more important for my argument, I will by quotation [2] try to convince you that the "Advancement of Learning," so immediately popular that Harvey must have known of it, would have appealed to him. Much of the argument is directed to show that a reform of method in the pursuit of knowledge is necessary. Thus, "For as things are now, if an untruth in nature be once on foot, what by reason of the neglect of examination and countenance of antiquity, and what by reason of the use of the opinion in similitudes and ornaments of speech, it is never called down" [3]. "For the handling of final causes, mixed with the rest in physical inquiries, hath intercepted the severe and diligent inquiry of all real and physical causes . . . to the great arrest and prejudice of further discovery . . . and have brought this to pass that the search for Physical Causes hath been neglected and passed in silence" [4]. "It being the nature of the mind of man (to the

extreme prejudice of knowledge) to delight in the spacious liberty of generalities and not in the enclosures of particularity" [5]. "Where there is much controversy, there is at many times little inquiry" [6]. "They hastened to their theories and dogmaticals and were imperious and scornful towards particulars" [7].

Next listen to a few quotations illustrating Bacon's plea for the experimental method. He says, "I find some collections made but commonly with a rejection of experiments familiar and vulgar. For it is esteemed a kind of dishonour unto learning to descend to inquiry upon matters mechanical" [8] (or, as we should say nowadays, experimental). "All true and fruitful Natural Philosophy hath a double scale or ladder, ascendent and descendent ; ascending from experiments to the invention of causes and descending from causes to the invention of new experiments" [9]. "Those experiments be not esteemed which have an immediate and present use, but those principally which are of most universal consequence for invention of other experiments [10]. The use of History Mechanical" (i.e., experimental) "is of all others

the most radical and fundamental towards Natural Philosophy" [11]. Then there is a fine passage emphasizing the value of experiment, too long to quote in full ; it begins, " But here was their chief error ; they charged the deceit upon the senses : which in my judgment are very sufficient to certify and report truth, though not always immediately, yet by comparison, by the help of instrument [12].

Nowadays it is at last recognized that those who spend their lives investigating Nature should be paid. Bacon anticipated us, saying : " There will hardly be any main proficiencie in the disclosing of Nature, except there be some allowance for expenses about experiments and therefore as secretaries and spials of princes and states bring in bills for intelligence, so you must allow the spials and intelligencers of Nature to bring in their bills, or else you shall be ill advertised " [13].

The " Advancement " tells us that medicine " is a most noble art," its object being " to tune this curious harp of a man's body and reduce it to harmony." The author pities the physician, for he is judged by the event " which

is ever but as it is taken ; for who can tell if a patient die or recover whether it be art or accident? And therefore many times the impostor is prized and the man of virtue taxed. Nay, we see the weakness and credulity of man is such, as they will often prefer a mountebank or witch before a learned physician " [14]. Consequently, physicians say to themselves, " If it befall to me as befalleth to the fools, why should I labour to be more wise ? " [15]. Bacon criticizes the doctors of the day quite fairly ; he finds that comparative anatomy, physiology and morbid anatomy are not studied as they should be, that no use is made of vivisection and that if " a man look into their prescripts and ministrations, and he shall find them but inconstancies and everyday devices without any settled providence or project " [16]. His attitude to medicine is shown in the sentence, " There is one thing still remaining which is of more consequence than all the rest : namely a true and active Natural Philosophy for the science of Medicine to be built upon " [17] ; and his attitude to science may be summed up in two sentences : " And this is the very thing

which I am preparing and labouring at with all my might—to make the mind of man, by help of art, a match for the nature of things [18]
. . . . when he uses some direction and order in experimenting, it is as if he were led by the hand” [19].

Surely, after these extracts, we must believe that Bacon’s own physician, Harvey, was influenced by his patient’s book which was widely known, was published some years before Harvey began his researches, contains much about medicine and preaches reform of method and the use of experiment, in both of which Harvey’s strength lay. I do not like to think that he was so ill-educated as not to have followed Shakespeare and other learned people in reading the “Advancement” by the author of the already popular essays, for Bacon’s contemporary, Ben Jonson, in a review of the great English writers, says of him, “he who hath filled up all numbers, and performed that in our tongue may be compared or preferred either to insolent Greece or to haughty Rome” [20]; and in these days we have Abbott speaking of Bacon’s unique mastery of the English language.

Remember, these words are said of a man writing at the time of Shakespeare and the Authorized Version, and then we get a measure of Bacon's greatness as a writer.

Another work of Bacon's that must have been known to Harvey, before the making of his discovery, is "*De Sapientia Veterum*," issued in 1609; it was much appreciated, was soon reprinted and was translated into other languages. Its general trend is welcome to a man well disposed towards experiment, for the proper investigation of Nature is recommended in it.

NOVUM ORGANUM.

In 1620 a book was published which began thus: "The Great Instauration. Pro-œmium. Francis of Verulam reasoned thus with himself and judged it to be for the interest of the present and future generations that they should be made acquainted with his thoughts" [21]. He tells us that the human intellect makes its own difficulties and hence ignorance and mischiefs innumerable. Therefore the author is "to commence a total reconstruction of sciences, arts and all human knowledge" [22].

Lest he should die before the work is finished, it was to be published in six parts. The first, which appeared after the second, was "De Augmentis." The second, issued in 1620, was the "Novum Organum," not quite completed. Only fragments of some of the other parts were ever written. Bacon calculated that "The Great Instauration" when finished would be sixfold as voluminous as Pliny. If this estimate is correct we only have one-twentieth of the whole.

The "Novum Organum" has all the beauties of the "Advancement," it is a masterpiece of condensed writing, without a word too many and each word precisely right. As with the "Advancement," I will give extracts which will show that it also is just such a book as would help to form a mind like Harvey's. In the "Plan" introducing us to the "Novum Organum" we find this: "The subtlety of experiments is far greater than that of the sense itself. I contrive that the office of the sense shall be only to judge of the experiment and that the experiment shall judge of the thing" [23]. "Those, however, who aspire not

to guess and divine, but to discover and know ; who propose not to devise, and mimic fabulous worlds of their own, but to examine and dissect the nature of this very world itself ; must go to facts themselves for everything ” [24]. In the preface is this eloquent exhortation : “ But if any man there be who aspires to penetrate further ; to overcome, not an adversary in argument, but nature in action ; to seek, not petty and probable conjectures, but certain and demonstrable knowledge ; I invite all such to join themselves, as true sons of knowledge with me, that passing by the outer courts of Nature which numbers have trodden, we may find a way at length into her inner chambers ” [25].

In the “ *Novum Organum* ” itself we are warned not to pin our faith to the syllogism, for the premisses being only words often there is no firmness in the superstructure, our only hope lies in a true induction ; we are reminded that we can only progress by the study of particulars. We are not to imagine or suppose, but to discover what Nature does or can be made to do.

We are told that “ it is the peculiar and perpetual error of the human intellect to be

more moved and excited by affirmatives than by negatives ; whereas it ought properly to hold itself indifferently disposed towards both alike " [26]. " What a man had rather were true he more readily believes " [27]. We suffer from " the mischievous authorities of systems, which are founded either on common notions or on a few experiments or on superstition " [28]. Then follows advice to physicians to renounce all varieties of false reasoning for " the entrance into the kingdom of man, founded on the sciences, being not much other than the entrance into the kingdom of Heaven, whereunto none may enter except as a little child " [29]. " The manner of making experiments which men now use is blind and stupid " [30]. " Men are inclined to turn aside from their experiments for some practical application of them ; like Atalanta, they go aside to pick up the golden apple and let victory escape them ; they should seek for experiments of light, not for experiments of fruit " [31]. A few pages further on we find this beautiful passage : " And an astonishing thing it is to one who rightly considers the

matter, that no mortal should have seriously applied himself to the opening and laying out of a road for the human understanding direct from the sense, by a course of experiment orderly conducted and well built up ; but that all has been left either to the mist of tradition, or the whirl and eddy of argument, or the fluctuations and mazes of chance, and of vague and ill-digested experience " [32]. " No one has yet been found so firm of mind and purpose as resolutely to compel himself to sweep away all theories and common notions, and to apply the understanding thus made fair and even to a fresh examination of particulars " [33]. " A greater abundance of experiments is to be sought for and procured " [34]. Then to magnify the dignity of investigation, Bacon quotes the proverb of Solomon, " The glory of God is to conceal a thing ; the glory of the king is to search it out " [35].

Bound up with the first edition of the " *Novum Organum*," Bacon published a " Description of a Natural and Experimental History such as may serve for the Foundation of a True Philosophy." The introduction

contains some of his most magnificent writing. Listen to this : “ Meanwhile what I have often said I must here emphatically repeat ; that if all the wits of all the ages had met or shall hereafter meet together ; if the whole human race had applied or shall hereafter apply themselves to Philosophy, and the whole earth had been or shall be nothing but academies and colleges and schools of learned men ; still, without a natural and experimental history such as I am going to prescribe, no progress worthy of the human race could have been made or can be made in philosophy and the sciences. Whereas, on the other hand, let such a history be once provided and well set forth, and let there be added to it such auxiliary and light-giving experiments as in the very course of interpretation will present themselves. . . . For in this way and in this way only, can the foundations of a true and active philosophy be established ; and then will men wake as from deep sleep, and at once perceive what a difference there is between the dogmas and figments of the wit and a true and active philosophy, and what it is in questions

of nature to consult nature herself" [36]. One more quotation from the same source I cannot resist : " Away with antiquities and citations or testimonies of authors " [37].

WAS HARVEY INDEBTED TO THE " NOVUM
ORGANUM."

But some may say all this is beside the mark, for, before this book appeared in 1620, Harvey, for about four years, had been teaching that the blood circulates. Thus in a leading article in the *British Medical Journal* we find " a comparison of dates shows that Harvey could not owe anything to the 'Novum Organum' " [38]. On the face of it, this appears a fair inference, but it is probably incorrect because of the following considerations. The most trustworthy account we have of Bacon is that by his chaplain, Rawley, who says : " His book of the 'Instauratio Magna' was the production of many years' labour and travel. I myself have seen at least twelve copies of the 'Instauration' revised year by year one after another, and every year altered and amended in the frame thereof, till at last

it came to that model in which it was committed to the press. . . . he would often ask if the meaning was expressed plainly enough" [39]. Further, many tracts, which are trials for the great book, were found among Bacon's papers after his death. Some were written as early as 1603-1605. I need not name them as they can all be found in "The Works of Francis Bacon." A quotation from the "Cogitationes" will suffice: "And it were shame that men should have examined so carefully the tinklings of their own voice and should yet be so ignorant of the voice of nature" [40]. Even from his youth Bacon had had in his mind the reformation of the processes by which knowledge is to be obtained, for at the age of 16, when an undergraduate at Cambridge, he was dissatisfied with the philosophy of Aristotle "for the unfruitfulness of the way."

We see, therefore, that for many years before the publication of the "Novum Organum," and before Harvey began his experiments, Bacon's mind was much occupied with it, and that he worked hard at it, making

numerous trials ; he certainly talked about it with his chaplain ; consequently it is likely that he talked about it with his physician, of whom, as we shall see presently, he probably saw much. For there was no secret about Bacon's philosophical work ; he invited criticism from several friends ; many had already read the " Advancement " published earlier ; he often spoke of his desire to study, and it was well known how he busied himself in his leisure. We can hardly err if we conclude that not only the thoughts expressed in the " Advancement," which we have seen Harvey had ample opportunity of reading before he began his experiments, but also those which simmered in Bacon's brain between the publication of this work and that of the " *Novum Organum*," in which they were embodied, were known to and affected Harvey, to whom they would have been particularly congenial, for he became one of the greatest of discoverers because he experimented and disregarded mere authority. It may be urged that we do not know the date at which Harvey became physician to Bacon. But it must have been sometime before Bacon's

fall early in 1621, for he was then deprived of his Lord Chancellorship, and we know that Harvey was physician to the Lord Chancellor; and further, Harvey would not have been appointed after Bacon's fall, for the rest of his life was spent either in the Tower, or in retirement from London. Therefore it is likely that Harvey was physician to Bacon before 1616, and even if not he probably knew him. Lastly, could it be shown that Harvey did not know Bacon before 1616, yet he would have read and been influenced by the "Advancement."

EFFECT ON SCIENCE OF BACON'S TEACHING.

If I have carried you in unison with me so far, you are with me in thinking that Bacon's teaching touched the mind of Harvey; still it will be an advantage to see if this opinion is strengthened by what others have thought of the position of Bacon's writings in the history of science. Aristotle and Leonardo da Vinci had experimented; several others, such as Albert the Great, Vanini, Campanella and Ramon Lull, as may be seen in Professor Peers' recent

translation of Blanquerna [41], saw that mere authority was allowed to override reason. Roger Bacon had laid down precepts that might have guided men aright, but, so abstract and dogmatic was the ordinary teaching up to the time of Francis Bacon, that these examples bore little fruit, being stifled under the mass of theological, metaphysical and commentatorial literature with which the Middle Ages abounded. Reasoning was almost entirely deductive, long trains of syllogism were drawn out without any inquiry as to whether the premisses were correct. It was Francis Bacon who caused this deadening fog, which bemused all originality, to roll back when he directed men to discard authority, to take nothing on trust which can anyhow be verified, and to seek out Nature by proper observation, proper reasoning and proper experiment. People of his own time saw this. Rawley says, "If there was a beam of knowledge derived from God upon any man in these modern times, it was upon him" [42]. Peter Heylin, who was a young man when the "Great Instauration" was first published, tells us: "The Lord Chancellor Bacon was a

man of most strong brain, and a chymical head . . . Pity it was, he was not entertained with some liberal salary, abstracted from all Affairs both of Court and Judicature, and furnished with sufficiency both of Means and Helps for the going on of his Design. Which had it been, he might have given us such a body of Natural Philosophy, and made it so subservient to the public good, that neither Aristotle nor Theophrastus amongst the ancients, nor Paracelsus or the rest of our latter chymists, would have been considerable" [43]. Sprat writes: "I shall only mention one Great Man who had the true Imagination of the whole extent of this Enterprise, as it is now set on foot; and that is, the Lord Bacon . . . His Genius was searching and inimitable" [44]. The enterprise was the foundation of the Royal Society, and it is generally allowed that it was Bacon's "New Atlantis," and the thoughts inspired in others by him, which led to the foundation not only of the Royal Society but also of several foreign scientific associations. Cowley, called metaphysical by Johnson, in his poem to this society, writes thus:—

“ Bacon, like Moses, led us forth at last,
The barren Wilderness he past,
Did on the very Border stand
Of the blest promis'd Land,
And, from the Mountain's top of his exalted Wit,
Saw it himself and shewed us it ” [45].

So much for the past opinion of Bacon's influence. During three centuries it has remained unchanged. We find Leibnitz [46] remarking, “ We do well to think highly of Verulam, for his hard sayings have a deep meaning in them.” Whewell [47] mentions no other author in his preface, and begins his book with a quotation from Bacon, and Macaulay writes that Bacon “ moved the intellects which moved the world.” Space allows me to quote only two modern writers. Professor Fowler [48] tells us, “ What Bacon says of Plato is pre-eminently true of himself, he was ‘ a man of a sublime genius who took a view of everything as from a high rock.’ He called men, as with the voice of a herald, from the house top to study nature. He popularized and dignified experimentation. It would hardly, I think, be an exaggeration to compare Bacon in the

intellectual sphere with Luther in the sphere of religion." Church [49] writes that Bacon "had the brightest, richest, largest mind but one, in the age which had seen Shakespeare and his fellows." Later on he says, "in temper, in honesty, in labour, in humility, in reverence, he was the most perfect example that the world has yet seen of the student of nature, the enthusiast for knowledge." In the introduction to Fowler's edition of the "Novum Organum" will be found a long list of testimonies by many writers to the extraordinary power that Bacon's teaching has had upon scientific thought and production. The chief claim that Bacon made for himself is quaintly expressed in the letter he wrote to Dr. Playfer: "I have only taken upon me to ring a bell to call other wits together (which is the meanest office), it cannot but be consonant to my desire to have the bell heard as far as can be" [50]. Truly its peal has been heard all over the world, and has reverberated for three centuries, and surely these references suggest that Harvey must have heard its call.

BACON'S PERSONALITY.

Having shown that Bacon's teaching was available to Harvey, was well known while he was a young man, and would be attractive to him, let us see whether the last is true also of Bacon's personality. Nobody is more likely to know him well than his secretary, Meautys, and his chaplain, Rawley. Both were devoted to him, and the first says his sole ambition is to grow up only under his lordship and, come what come may, to serve him with his life and fortune, laying down all he has at his feet [51]. The second shows us that Bacon must have been a delightful conversational companion. "His meals were refectations of the ear as well as of the stomach . . . wherein a man might be refreshed in his mind and understanding no less than in his body. . . . In which conversations . . . he was no dashing man, as some men are, but ever a countenancer and fosterer of another man's parts. Neither was he one that would appropriate the speech wholly to himself, or delight to outvie others, but leave a liberty to the co-assessors to take their turns" [52].

Tobie Mathew, son of the Archbishop of York, says of Bacon : “ It is not his greatness I admire, but his virtue. It is not the favours I have received of him that have enthralled and enchained my heart, but his whole life and character : which are such that, if he were of an inferior condition, I could not honour him the less, and if he were my enemy I should not the less love and endeavour to serve him ” [53].

Ben Jonson tells lovingly of his virtue and thus of his speech : “ No man ever spake more neatly, more pressly, more weightily, or suffered less emptiness, less idleness, in what he uttered. . . . No man had their affections more in his power. The fear of every man that heard him was lest he should make an end ” [54].

His secretary and apothecary, Boener, hoped that a statue of him would be put up, not because of his learning but on account of his being “ a memorable example to all of virtue, kindness, peacefulness and patience ” [55].

We know a man by his friends. Bacon drew them from everywhere. There were many

abroad and in this country—Essex, Buckingham, Lancelot Andrewes, Selden, Bodley, Hobbes, Jonson, Mathew, and George Herbert, the poet, who helped in the translation of the “Advancement” into Latin, and who wrote verses in praise of Bacon, who in his turn dedicated his versification of the Psalms to Herbert, saying he was his affectionate friend. Bacon had few enemies, the chief was Coke, his professional antagonist. He was popular, as we learn from the fact that when he took his seat as Lord Keeper, besides the servants, the Judges and the Inns of Court, he was accompanied by most of the nobility, with other gallants to the number of two hundred horse.

All this shows him to have been a lovable, charming person, with whom everybody would enjoy talking, and it is incredible that his physician did not converse with him and that he was ignorant of his teaching.

BACON'S HEALTH.

On the whole, Bacon's health was good ; nevertheless he was a chronic dyspeptic, giving

considerable thought to his health and indulging abundantly in physic, especially aperients. He has left us very particular accounts of how he took these and how they acted in 1608 [56].

In 1617 he had an illness thought to be gout, but it only lasted a few days. A contemporary letter [57] says, "he hath so tender a constitution, both of body and mind, that he will hardly be able to undergo the burden of so much business." This surmise was incorrect, for during the next four years Bacon worked very hard. Two years later he was away from work for a time, probably owing to an attack of stone, "which held him in great pain two or three days" [58]. That he was very fond of taking medicine is shown by these and other references, and by a letter written in 1623, which is of interest as having to do with the separation of the "Company of Potycaries" from that of Grocers. In it he says, "You may perhaps think me partial to Potycaries, that have been ever puddering in physic all my life" [59].

Bacon depended on his physicians. When he was let out of the Tower, he was not

allowed to come within the verge of the Court, and thus he could not live in London. In some moods he thought the Tower preferable to such liberty, for he wrote in his petition to the House of Lords, "there I could have company, physitians," and he said the same in two letters to Buckingham, to whom, in a letter two years later, he again speaks of his physicians whom he calls strange creatures. It is difficult to conceive a patient more likely to consult his physician frequently than one who was a chronic introspective dyspeptic, rejoiced in purgatives, had gout and a stone, especially as we have just seen that this patient was one with whom the physician would have delighted to talk, and many statements in "*Sylva Sylvarum*" suggest that Bacon often discoursed with doctors.

Further, apart from the relationship of patient and physician, Bacon and Harvey must have seen much of each other, for London was no bigger than a large provincial town of the present time, both moved among the Court and nobility, and both were in the small class of the well educated. Bacon was no recluse,

and attached much importance to mixing in society. For example, in 1613, on the occasion of the marriage of the Earl of Somerset, he gave a masque costing him £2,000, a very large sum in those days, and later he gave a sumptuous party at York House to celebrate his sixtieth birthday.

HARVEY'S MIND SIMILAR TO BACON'S.

I have now finished what may be called the Baconian side of my argument. The Harveian side will be much shorter. The philosopher said observe and experiment properly, deduce scientifically, without attention to mere authority. No one could have done this more rigorously than the physician whose mind was in this matter the counterpart of that of the philosopher, for Harvey said to Ent, "I have oftentimes wondered and even laughed at those who have fancied that everything had been so consummately and absolutely investigated by an Aristotle or a Galen, or some other mighty name, that nothing could by any possibility be added to their knowledge" [60]. In the introduction to his work on the "Generation

of Animals," he writes: "Without the due admonition of the senses, without frequent observation and reiterated experiment, our mind goes astray after phantoms and appearances." Further on: "The method of investigating truth commonly pursued at this time, therefore, is to be held erroneous and almost foolish, in which so many inquire what others have said, and omit to ask whether the things themselves be actually so or not." Or to take a passage from the introduction to "*De Motu*." "It will be proper to look more narrowly into the matter; to contemplate the motion of the heart and arteries, not only in man, but in all animals that have hearts; and further, by frequent appeals to vivisection and constant ocular inspection, to investigate and endeavour to find out truth."

Really, except that the language has not the mighty grandeur of that of Bacon, it might be he writing. So do the minds of Bacon and Harvey jump together that we are constrained to believe that the elder influenced the younger, particularly when we recollect the other reasons already given for this belief. Bacon often tells

us that the philosopher ought not to be occupied merely with contemplating Nature, but that he must employ his knowledge for the relief of man's estate. This has led to his being called a utilitarian, but it is an attitude of mind similar to that of Harvey.

VALUE OF EVIDENCE THAT HARVEY WAS NOT INFLUENCED BY BACON.

In the Harveian oration for 1922 Arnold Chaplin said: "It is hard to believe that Harvey, who knew Bacon well, was not influenced to some extent by that capacious mind," nevertheless the view put forward by me to-day of the relationship between them is not that held by many writers, several of whom speak of Harvey's contempt for Bacon, or state that he can owe nothing to him. Those who maintain the last have forgotten the "Advancement" and the history of the "Novum Organum." All who profess the first base it on the following: Aubrey [61] tells us, "He (Harvey) had been physician to the Lord Chancellor Bacon, whom he esteemed much for his witt and style, but

would not allow him to be a great philosopher. 'He writes philosophy like a Lord Chancellor,' said he to me, speaking in derision; 'I have cured him.' "

Assuredly this anecdote does not justify the belief that Harvey was not affected by Bacon. Aubrey tells us that it was not until 1651 that he became acquainted with Harvey, who was then seventy-three years old. Aubrey's statement is probably muddled, for, as Bacon had been dead twenty-five years, Harvey most likely said "he wrote," and for the same reason should have said, "I cured him," and Aubrey does not make it clear whether Bacon was cured of a bodily ailment or of writing philosophy like a Lord Chancellor. Harvey, who according to Aubrey, was very choleric and was certainly aged, was speaking of a patient dead twenty-five years before, and, being choleric, may easily, for mere argument's sake, have taken the other side to Aubrey in not allowing Bacon to be a great philosopher, and we must also remember that even if this were Harvey's deliberate opinion, others have thought so too, but have, nevertheless, con-

sidered that Bacon did more than anyone to point the way to the proper mode of scientific research. We only have Aubrey's statement that Harvey spoke in derision of Bacon's way of writing ; but even if he did, he can only have meant that Bacon wrote in a stately, dignified, perhaps rather pontifical manner ; if he meant anything else he was very foolish, for, as I have already shown, it was allowed when Bacon was alive, and has been ever since, that few have matched his prose. Certainly there is nothing in this story to suggest that Bacon did not influence Harvey. Indeed, it is the other way, for he must have read the philosopher before he could give an opinion as to how he wrote, and we are told he esteemed his wisdom and style.

But quite apart from this argument there is another reason why we should not pay any attention to this anecdote, namely, that Aubrey is quite unreliable. He did not begin his "Lives" till 1680, when he put each name in a book ; then under it, when anything came into his head, he wrote hastily, without reference to notes, his recollections of the person ; this was

usually done in the morning, often in the midst of sickness following a night's drunken debauch, and rarely revised. Harvey had been dead twenty-three years when this oft-quoted tale of what he said about Bacon, who had been dead fifty years, was jotted down in this manner by a gossiping drunkard, who owns that he wrote "tumultuarily." Look at it as we may, it is worthless as evidence as to what sway Bacon had over Harvey. Indeed, Andrew Clark, Aubrey's editor, says "Aubrey's 'Lives' supply an inviting field for comment, correction and addition. But, even so treated, they will never be a biographical dictionary. Their value lies not in statement of biographical or other facts" [62].

It has been implied that, because Harvey is nowhere mentioned by Bacon, we may infer that the two were not in accord, but it must be remembered that three hundred years ago it was not customary for one author to allude to another as frequently as it is now. In a notebook of Bacon's under the date July 26, 1608, he says he must ask for opinions about his scientific work from the physicians, Poe,

Paddy, and Hamond, but there is nothing to show that he ever did this. He would hardly have asked Harvey, for he was then only thirty years old and probably was, at that time, unknown to Bacon [63]. I have looked through everything he wrote, and it is clear that his chief scientific interest was in physical science, especially astronomy, certainly not in physiology. He made several attempts at scientific investigation, but not a single one was physiological. Very many phrases having a medical or a physiological bearing are to be found in his writings, especially in "The History of Life and Death," and in "Medical Remains," but they are all curious isolated statements; if an explanation of them is given, it is not Bacon's, he merely reproduces the popular explanation. He collected hundreds of these statements for future investigation. Most we now know to be fantastic nonsense. Further, although he taught the use of induction and experiment, he was so constituted as to have no aptitude whatever for experimentation. This interesting aspect of his mental equipment is fully discussed by Spedding in his preface to the "De Interpretatione Naturæ Præmium."

“De Motu” was published in 1628; Bacon died in 1626. Therefore he could not have alluded to the book. Harvey, in his Lumleian Lectures, began to teach his new doctrines not earlier than 1616. But there is no evidence that Bacon was ever present at these lectures; indeed, from 1616 to 1620 he was at the very busiest part of his legal, political and literary career; he was consolidating the laws of England; his advice was constantly being sought by the King and by Villiers, to whom he addressed a long political essay; and he was writing the “Novum Organum”—indeed it was marvellous that he got through all he did. He certainly had no time then to attend lectures, nor to pay much attention to rumours which might come to him saying that a great discovery had been made, especially as Harvey’s experiments were then unconfirmed; indeed, if Bacon had asked doctors, he would probably have been told that the new doctrines were nonsensical, for we know that many of the medical profession did not think Harvey’s views worthy of discussion. So far from its being surprising that there is

nothing in the "Novum Organum," published in 1620, about Harvey's discovery which he began to teach, but only orally, some four years before, it would have been astonishing if there had been anything.

In "The History of Life and Death," published in 1623, Bacon says "The blood is that which irrigates the juices and membranes" and "the blood of the veins supplies the blood of the arteries" [64]. It might be thought that these sentences show that he knew something of the circulation of the blood; but my strong opinion, judging by the context, is that he still knew nothing about it. Nor is this to be wondered at, for Bacon, after his release from the Tower in 1621, lived a lonely life away from London, and therefore would not hear of Harvey's lectures, and even if he had he would probably have lacked interest in them, for his health was poor and his debts were burdensome. To sum up, the neglect of Bacon to mention Harvey is easily explained, and is of no value as indicating that the two were antipathetical.

It may be said that I have brought forward

no direct proof of any influence of Bacon on Harvey, all my evidence is circumstantial. But two things are to be remembered ; firstly, circumstantial evidence is often much stronger than direct ; secondly, how little we know of the daily doings of people who lived three hundred years ago ; for example, we know almost nothing of Bacon's first projected marriage, nor whether he got some land which he asked of Elizabeth. Over and over again there is a reference in a letter to something Bacon had on hand, but of the outcome of which we are completely ignorant. Spedding writes : " It is singular that of two men so remarkable in their several ways as Bacon and Coke, whose fortunes, objects, tastes, ideas and dispositions crossed each other at so many points, and whose business must have brought them so continually into company and so frequently into conflict, —the personal relations should be so little known. No anecdotes have been preserved by the news writers of the day which enable us to form a clear idea of their behaviour to each other when they met—the style of their conversation, or the temper of their courtesies " [65].

This being so, it is not strange that we have no direct proof of Bacon's influence upon Harvey.

GILBERT'S INFLUENCE.

Everything goes to show that Harvey was regarded with affection by his own profession. He speaks of his "very dear friend Dr. Argent," we know of Ent's tenderness for and admiration of him, of Prujean's esteem for him. His generosity to this College tells us that the Fellows of it were his friends, whom he much loved, but there is no indication that among these medical friends there was any one of sufficient originality to help to mould Harvey's thoughts, with a single exception, namely William Gilbert, one of the great original geniuses among the great Elizabethans.

He was born in 1540 at Colchester, went to Cambridge, took his M.D. there, became a Fellow of St. John's, travelled abroad, and settled to practise in London in 1573, ultimately living in Wingfield House, Peter's Hill, which leads from St. Paul's Churchyard to Upper Thames Street. Silvanus Thompson's [66]

statement that his relations with English physicians were intimate and extensive must be correct, for Gilbert held several offices at this College, becoming President in 1600. He was well known outside his profession, for he attended many celebrated people and was physician to Queen Elizabeth; the story that she left him a legacy shows her liking for him. Gilbert and Dr. Lancelot Browne, in 1584, together signed a medical certificate which is preserved in the Records Office; in 1588 both were selected to advise the Privy Council about the health of the Navy, and Browne held various offices at the College of Physicians—so, in one way and another, he must have known Gilbert well. Lancelot Browne's daughter married Harvey in 1604. Gilbert died in 1603. Considering the close acquaintanceship between Gilbert and Browne, Harvey must have heard much of the first and quite likely he met him when he was courting; anyhow it appears that he knew a good deal about him, for Silvanus Thompson tells us that, "according to Harvey, Gilbert expended no lesser sum than five thousand pounds on his researches."

Therefore we may conclude that, for both professional and family reasons, Harvey would be inclined to pay attention to anything Gilbert said.

Gilbert's outstanding position is due to this : he broke away from tradition, he challenged authority, he went to Nature herself, investigating her by experiment, and he employed proper inductive reasoning. The first words in the preface of his famous book, "On the Magnet, magnetick bodies also, and on the great magnet the earth ; a new Physiology demonstrated by many arguments and experiments" are : "In the discovery of secret things and in the investigation of hidden causes, stronger reasons are obtained from sure experiments and demonstrated arguments than from probable conjectures and the opinions of philosophical speculators of the common sort But if any see fit not to agree with the opinions here expressed and not to accept certain of my paradoxes ; still let them note the great multitude of experiments and discoveries—these it is chiefly that cause all philosophy to flourish ; and we have dug them up and demonstrated

them with much pains and sleepless nights and great money expense " [67].

This book made Gilbert the father of experimental philosophy in this island; it is the earliest known work treating of both magnetism and electricity; few finer examples of inductive reasoning have ever been presented to the world; there is abundant testimony that it produced a deep impression, not only in this country, but throughout the civilized universe; it places Gilbert on a level with Harvey, Galileo, Gassendi and Descartes [68]. Galileo says: "I extremely praise, admire and envy this author for that a conception so stupendous should come into his mind. I think him moreover worthy of extraordinary applause for the many new and true observations he has made" [69] [70]. Sir Kenelm Digby writes, "by means of whom (Gilbert) and of Doctor Harvey our nation may claim even in this latter age as deserved a crown for solid Philosophical learning" [71].

Coming down to modern times, C. W. Cooke [72] tells us that "De Magnete" inaugurated a new epoch in physical science, its author

announced discovery after discovery, all made by a series of experiments conducted in a most philosophical manner. He was the first electrician ; he was the first to investigate electrical phenomena, and the word electric was coined by him. Towards the end of the last century a Gilbert Club was formed ; under its guidance a new translation of “ De Magnete ” appeared, and in the notes which accompany this Silvanus Thompson tells us that he considers that Gilbert made twenty separate experimental discoveries in electricity alone. It was he who showed, by experiment piled upon experiment, that the earth is a great magnet ; he was the first in England to espouse the Copernican Theory and he told us that the fixed stars are at various distances from the earth.

It will not be amiss, before we leave “ De Magnete,” to glance at the short reference to medicine to be found in it. In Book I, chapters xiv and xv, Gilbert [73] ridicules the medical nonsense which has been talked about the loadstone, such as that, in small doses, it preserves youth ; that smeared with garlic it ceases to be active ; that when pulverized and

then buried in a plaster, it will draw an arrow from the body ; that it will cure all sorts of headaches. He sums up by saying : “ Thus vainly and preposterously do the sciologists look for remedies when ignorant of the true causes of things.” Chapter xv treats of the medicinal virtue of iron. Gilbert is aware of its use in chlorosis, for “ it restores young girls when pallid, sickly and lacking colour, to health and beauty.” Malaria was very common in England in his time, hence we find Gilbert advising iron for enlarged spleen ; the patients improved probably because the iron benefited their anæmia. He notices that it is astringent. These are its only medicinal virtues. He considers that the best form in which to use it is as a fine powder steeped in the “ sharpest vinegar ” and dried. This is an excellent account of the therapeutics of iron, we know but little more now. Gilbert is very sarcastic about the many ridiculous claims made for it by doctors. He says, “ Thus do the smatterers cross swords together, and puzzle inquiring minds by their vague conjectures, and wrangle for trifles as for goats’ wool, when they philo-

sophize wrongly." In Book II, chapter iii, he points out that Galen errs in believing that whatever agents draw out the venom of serpents exhibit the same power as the loadstone, he is emphatic that drugs do not act in this way. These extracts show him to have been what was very rare in his day, namely, a scientific physician, believing no more than he sees, and scornfully disbelieving the rubbish that passed for medicine.

"The Advancement of Learning" appeared in 1605, two years after Gilbert's death, so it cannot have been of use to him, and the only one of Bacon's writings which can have been published before 1600, when "De Magnete" appeared, is "Partus Masculus Temporis" (The Male Birth of Time), but the date of this, which is only a fragment, is doubtful. There is no trace of any acquaintance between Gilbert and Bacon, therefore we must admit that there is nothing to show that the last can have affected the elder; consequently the glory of being the first in this country, at any rate, to break through the bonds of authorities and to properly use experiments and induction, belongs to

Gilbert. Considering his professional position, his sound medicine, his close acquaintance with Harvey's father-in-law, the fact that his arresting book appeared just when Harvey was beginning his medical work, that it was just such as would appeal to the discoverer of the circulation (for it, by example and precept, taught that the right way to investigate Nature was by experiment and induction), and that Harvey's recreation was mathematics : bearing in mind all this, it is not unreasonable to believe that Gilbert helped to direct Harvey's thoughts.

ATMOSPHERE IN WHICH GILBERT, BACON AND HARVEY LIVED.

Hitherto we have only considered Bacon, Gilbert and Harvey individually ; but in what atmosphere did they live? Sir John Edwin Sandys tells us that "the love of discussing on learned and philosophic topics was one of the characteristics of serious society in the Elizabethan age" [74]. Sir Sidney Lee and Dr. Furnivall both say that the era of Elizabeth was that of learned culture and a desire for

knowledge among large numbers of the people [75]. Several accounts have been given of the Society of Antiquaries, founded in 1572. It was a great success. "Peers and commoners, diplomatists and exchequer officials, heralds and city tradesmen, country and town gentlemen, schoolmasters, lawyers and clergymen, all met together, week by week, to discuss archeological and constitutional problems" [76], [77], [78]. At the same time there was another learned society which met at Gilbert's house on St. Peter's Hill. Sir Humphrey Gilbert, half brother to Sir Walter Raleigh, laid before Queen Elizabeth a scheme for the erection of "An Achademy for educacion of her Maiestes Wardes and others, the youth of nobility and gentlemen." It was to have been a real University of London; there were to be dozens of well-paid teachers, including one in Natural Philosophy, and there was to be one doctor of physic. His duties I will give in the old spelling. One day he was to reed phisick and another surgery, in the English tongue. He was never to alleage any medicine of any kind but that he was to declare the

reason philosophicil of every particular, and he was to show how the medicine was made and all the instruments used in making it. The physitian was to practise surgery because there were very few good surgeons, for surgery was only to be learned in barbers' shops, which was most dangerous. The physitian was continually to practise with the Natural Philosopher to try and search out the riddles of Nature, they were to share a garden for the growing of simples and for this they were to have an extra allowance [79].

Learning was evidently much in men's thoughts and in their conversation. Therefore, on this ground also, we may reasonably conclude that Harvey would have knowledge of the teaching of Gilbert and Bacon.

Many who have written about the glorious Elizabethan renaissance have told us of its literature, its theatres, its politics, its statesmen, its voyagers and its romance, but few have dwelt upon its science. Until the later years of the great Queen's reign, ignorance, superstition, tradition and false reasoning darkened understanding; but then, as with other branches

of human activity, so with science, great lights arose in this country—Gilbert, Bacon and Harvey ; men's minds awoke, the science of electricity was founded, we were taught how to reason, and modern physiology was born. English science dates from these three who were contemporaries ; fortunately, they were not, like Galileo, Bruno, Servetus and others, persecuted on account of the novelty of their pronouncements. The Elizabethan era is an example of the well-known, singular phenomenon that there are periods in which a cluster of geniuses appears, and this College can justly be proud that two of its Fellows may be grouped with Shakespeare and a few others among the greater Elizabethans. Harvey's supreme eminence among scientists is so well acknowledged that there is no need for me to extol it. Rather have I tried to show that not only was he a star of the first magnitude himself, but he was also part of one of the brightest constellations the world has seen. No man can certainly say what makes any man's mind, but, for the reasons brought forward in this address, it does seem likely that,

as Harvey was the youngest of these three, the other two had some directing effect, of which Harvey was perhaps unaware, in steering his thoughts correctly towards that goal, the reaching of which has made him one of the great men of all time.

All three were parched with a thirst for knowledge, and it would be difficult to find a better epilogue to this oration than a quotation from the "Praise of Knowledge," a masque written by Bacon, and performed before Elizabeth in 1592: "Therefore no doubt the sovereignty of man lieth hid in knowledge wherein many things are reserved which kings with their treasure cannot buy, nor with their force command; their spies and intelligencers can give no news of them; their seamen and discoverers cannot sail where they grow. Now we govern nature in opinions but are thrall to her in necessities. But if we would be led by her in invention we should command her in action."

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